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INVENTOR-INFORMATION:

NAME

TANAKA, YASUHIRO

ASSIGNEE-INFORMATION:

NAME

COUNTRY

MURATA MFG CO LTD

N/A

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ABSTRACT:

PURPOSE: To keep the connection reliability to resolve a package defect by forming an arbitrary number of recessed and projecting parts in an arbitrary part of edges in the breathwise direction of at least one of an intermediate electrode and external electrodes.

CONSTITUTION: An intermediate electrode 8 connected to both principal faces facing each other and both end faces facing each other of a piezoelectric resonator 1 is formed between a pair of external electrodes 7 and 7, and electrostatic capacity parts are formed between the intermediate electrode 8 and external electrodes 7 and 7. When wide recessed parts 9 and 9 are formed

in both edges in the breathwise direction of the intermediate electrode 8 existing on one principal face facing the other principal face as the package face of the piezo-electric resonator 1, the electrode width of the intermediate electrode 8 is narrowed and the gaps between the intermediate electrode 8 and external electrodes 7 and 7 are widened on one principal face, and electrostatic capacities obtained between the intermediate electrode 8 and external electrodes 7 and 7 are minimized. Further, the electrode width of the part continuously formed on the other principal face as the package face and both end faces facing each other of the intermediate electrode 8 is fixed and stabilized.

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(71)出願人 000006231

株式会社村田製作所

京都府長岡京市天神二丁目26番10号

(72)発明者 田中 康廣

京都府長岡京市天神二丁目26番10号 株式

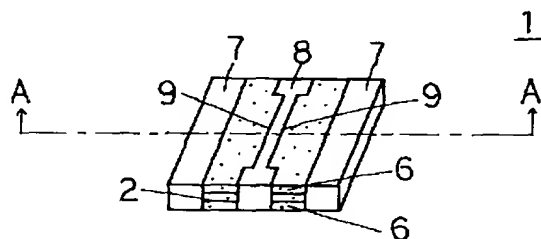
会社村田製作所内

(54)【発明の名称】 圧電共振子

(57)【要約】

【目的】表面実装型のコンデンサ内蔵圧電共振子において、中間電極の電極幅を狭くすると、実装面での半田供給面積が狭くなり接続の信頼性が得られず実装不良となり、反対に中間電極の電極幅を広くすると、実装面に供給される半田同士が接触してショートする等の品質不良となる。本発明ではこの様な問題を解決することを目的とする。

【構成】所要の静電容量を得る為に、実装面と対向する面に存在する中間電極8および外部電極7、7のうち、少なくとも1つの電極の幅方向の端縁に凹凸状部9、9を形成する。



【特許請求の範囲】

【請求項1】対向する振動電極に導通する一対の入出力電極が主面の両端部に形成された圧電基板と、該圧電基板の振動電極上に空間を設けて、圧電基板を上下から挟持するように接着された封止基板とを備えて略直方体形状の積層体を成し、該積層体の両端部に前記圧電基板の一対の入出力電極に導通する一対の外部電極が形成され、該一対の外部電極の中間に中間電極が形成された圧電共振子において、圧電共振子の実装面と対向する面に存在する中間電極および外部電極のうち、少なくとも1つの電極の幅方向の端縁に、凹凸状部を形成したことを特徴とする圧電共振子。

【請求項2】対向する振動電極に導通する一対の入出力電極が主面の両端部に形成された圧電基板と、該圧電基板の振動電極上に空間を設けるように、圧電基板の略両端部を保持して収納する略直方体形状のケースとを備え、該ケースの両端部に前記圧電基板の一対の入出力電極に導通する一対の外部電極が形成され、該一対の外部電極の中間に中間電極が形成された圧電共振子において、圧電共振子の実装面と対向する面に存在する中間電極および外部電極のうち、少なくとも1つの電極の幅方向の端縁に、凹凸状部を形成したことを特徴とする圧電共振子。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、発振回路やフィルタ回路等に使用される、表面実装型のコンデンサ内蔵圧電共振子に関する。

【0002】

【従来の技術】従来のこの種の積層型圧電共振子81の斜視図を図10に示し、該圧電共振子81の垂直断面図を図11に示す。圧電共振子81の圧電基板82は対向する振動電極83、83に導通する一対の入出力電極84、84が主面の両端部に形成されている。

【0003】該圧電基板82には、振動電極83、83の振動を可能とする空間を設ける為に振動電極83、83上とその周囲を残して接着剤85、85が塗布されており、該接着剤85、85を介して2枚の封止基板86、86が前記圧電基板82を上下から挟持するように接着され、略直方体形状の積層体を成している。尚、前記接着剤85、85により形成される接着層は、振動電極83、83の振動が可能な程度に塗布されていれば良いが、実際は圧電共振子81の端面方向から肉眼で見ても現われないことが多い。

【0004】圧電共振子81の両端部において、圧電基板82の一対の入出力電極84、84に導通する一対の外部電極87、87が、圧電共振子81の対向する両主面および対向する両端面に一定の幅で連続して形成さ

れ、かつ、対向する両側面にも形成されている。

【0005】該一対の外部電極87、87の中間には中間電極88が、圧電共振子81の対向する両主面と対向する両端面に一定の幅で連続して形成され、中間電極88と一対の外部電極87、87との間ではそれぞれ静電容量部が形成される。

【0006】ここで図12に示すように、圧電共振子91の対向する両主面および対向する両端面に連続して形成された中間電極98の電極幅を狭く、該中間電極98と一対の外部電極97、97とのギャップを広くすれば、より少量の静電容量が得られる。

【0007】反対に図13に示すように、圧電共振子101の対向する両主面および対向する両端面に連続して形成された中間電極108の電極幅を広く、該中間電極108と一対の外部電極107、107とのギャップを狭くすれば、より多量の静電容量が得られる。

【0008】

【発明が解決しようとする課題】前記従来の圧電共振子においては、次のような問題点がある。圧電共振子91はより少量の静電容量を得る為に中間電極98の電極幅が狭く形成されているので、図示しないプリント基板への実装時に、圧電共振子91の一方主面である実装面における中間電極98への半田供給面積も狭くなることから、接続の信頼性が得られず実装不良となる場合があった。

【0009】一方の圧電共振子101はより多量の静電容量を得る為に中間電極108と一対の外部電極107、107とのギャップが狭く形成されているので、図示しないプリント基板への実装時に、圧電共振子101の一方主面である実装面における中間電極108と一対の外部電極107、107との間で、供給される半田同士が接触しショートする等、絶縁の信頼性が得られず、品質不良となる場合があった。本発明はこのような問題を解決することを目的とする。

【0010】

【課題を解決するための手段】本発明は以上の目的を達成する為に、対向する振動電極に導通する一対の入出力電極が主面の両端部に形成された圧電基板と、該圧電基板の振動電極上に空間を設けて、圧電基板を上下から挟持するように接着された封止基板とを備えて略直方体形状の積層体を成し、該積層体の両端部に前記圧電基板の一対の入出力電極に導通する一対の外部電極が形成され、該一対の外部電極の中間に中間電極が形成された圧電共振子において、圧電共振子の実装面と対向する面に存在する中間電極および外部電極のうち、少なくとも1つの電極の幅方向の端縁に、凹凸状部を形成したことを特徴とする圧電共振子を提供する。又は、対向する振動電極に導通する一対の入出力電極が主面の両端部に形成された圧電基板と、該圧電基板の振動電極上に空間を設けるように、圧電基板の略両端部を保持して収納する略

直方体形状のケースとを備え、該ケースの両端部に前記圧電基板の一对の入出力電極に導通する一对の外部電極が形成され、該一对の外部電極の中間に中間電極が形成された圧電共振子において、圧電共振子の実装面と対向する面に存在する中間電極および外部電極のうち、少なくとも1つの電極の幅方向の端縁に、凹凸状部を形成したことを特徴とする圧電共振子を提供する。

【0011】

【作用】以上のように本発明によれば、所要の静電容量を得る為に、実装面である一方主面と対向する他方主面に存在する中間電極および外部電極のうち、少なくとも1つの電極の幅方向の端縁に凹凸状部を形成するので、圧電共振子の一方主面である実装面においては安定した中間電極幅及び該中間電極と一对の外部電極とのギャップが得られる。

【0012】

【実施例】図1は本発明における第1の実施例に係る積層型圧電共振子1の斜視図であり、図2は該圧電共振子1の垂直断面図である。圧電共振子1は圧電基板2、接着剤5、5、2枚の封止基板6、6、一对の外部電極7、7、中間電極8で構成されている。

【0013】圧電基板2の対向する主面のほぼ中央には対向する振動電極3、3が形成され、該振動電極3、3に導通する一对の入出力電極4、4が主面の両端部に形成されている。

【0014】該圧電基板2の対向する主面には、振動電極3、3の振動を可能とする空間を設ける為に振動電極3、3上とその周囲を残して接着剤5、5が塗布されており、該接着剤5、5を介して2枚の封止基板6、6が圧電基板2を上下から挟持するように接着され、略直方体形状の積層体を成している。尚、前記接着剤5、5により形成される接着層は、振動電極3、3の振動が可能な程度に塗布されれば良い為、実際は圧電共振子1の端面方向から肉眼で見ても現われないことが多い。

【0015】圧電共振子1の両端部において、圧電基板2の一对の入出力電極4、4に導通する一对の外部電極7、7が、圧電共振子1の対向する両主面および対向する両端面に一定の幅で連続して形成され、かつ、対向する両側面にも形成されている。

【0016】該一对の外部電極7、7の中間には中間電極8が、圧電共振子1の対向する両主面および対向する両端面に連続して形成され、中間電極8と一对の外部電極7、7の間ではそれぞれ静電容量部が形成される。

【0017】ここで図1に示すように、圧電共振子1の実装面である一方主面对向する他方主面において存在する中間電極8の幅方向の両端縁に、幅広の凹状部9、9を形成すると、他方主面において中間電極8の電極幅は狭く、該中間電極8と一对の外部電極7、7とのギャップは広くなり、中間電極8と一对の外部電極7、7との間でそれぞれ得られる静電容量を少量にすることが出

来る。

【0018】しかも中間電極8の実装面である一方主面および対向する両端面に連続して形成された部分の電極幅は、一定かつ安定したものが得られる為、図示しないプリント基板への実装時に、圧電共振子1の実装面における中間電極8への半田供給面積も狭くなることはない。

【0019】図3は本発明における第2の実施例に係る積層型圧電共振子11の斜視図である。圧電共振子11は圧電基板12、接着剤、2枚の封止基板16、16、一对の外部電極17、17、中間電極18で構成されており、中間電極18を除く圧電基板12、接着剤、2枚の封止基板16、16、一对の外部電極17、17は前記第1の実施例に係る圧電共振子1のものとそれぞれ共通である。

【0020】圧電共振子11の一对の外部電極17、17の中間には中間電極18が、圧電共振子11の対向する両主面および対向する両端面に連続して形成され、中間電極18と一对の外部電極17、17の間ではそれぞれ静電容量部が形成される。

【0021】ここで図3に示すように、圧電共振子11の実装面である一方主面对向する他方主面に存在する中間電極18の幅方向の両端縁に、幅広の凸状部19、19を形成すると、他方主面において中間電極18の電極幅は広く、該中間電極18と一对の外部電極17、17とのギャップは狭くなり、中間電極18と一对の外部電極17、17との間でそれぞれ得られる静電容量を多量にすることが出来る。

【0022】しかも中間電極18の実装面である一方主面および対向する両端面に連続して形成された部分の電極幅は、一定かつ安定したものが得られる為、図示しないプリント基板への実装時に、圧電共振子11の実装面において、中間電極18と一对の外部電極17、17との間で、供給される半田同士が接触することはない。

【0023】第3の実施例として図4に示すように、積層型圧電共振子21の実装面である一方主面对向する他方主面に存在する、一对の外部電極27、27の幅方向の端縁に凹状部29、29又は凸状部を形成する場合も有効である。或いは第4の実施例として図5に示すように、積層型圧電共振子31の実装面である一方主面对向する他方主面に存在する、中間電極38の幅方向の両端縁に凹状部39a、39a又は凸状部を形成すると共に、一对の外部電極37、37の幅方向の端縁に凹状部39b、39b又は凸状部を形成する場合も有効である。

【0024】尚、明細書でいう凹凸状部とは、第5の実施例として図6に示す積層型圧電共振子41の中間電極48において凹状部49、49、49、49を4箇所形成する等のように、凹状部又は凸状部を複数形成する場合も含み、その個数は任意である。

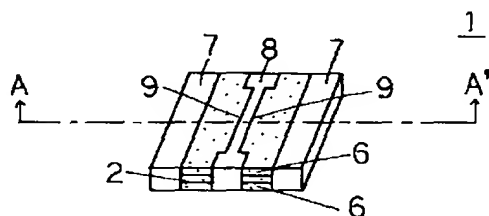
【0025】第6の実施例として図7に示すように、積層型圧電共振子51の実装面である一方主面に対向する他方主面に存在する、中間電極58の幅方向のそれぞれの端縁に凹状部59a及び凸状部59bの両方を形成し、それぞれで得られる静電容量を異にする場合も有効である。或いは第7の実施例として図8に示すように、積層型圧電共振子61の実装面である一方主面に対向する他方主面に存在する、中間電極68の幅方向のそれぞれの端縁に凹状部69aおよび凸状部69bの凹凸両方を形成すると共に、一方の外部電極67aの幅方向の端縁に凹状部69c又は凸状部を形成する場合も有効である。又、図7で示す中間電極58の凸状部59bを構成するクラック部50のように、凹凸状部を構成するクラック部は直角に限らず鈍角、鋭角或いは丸みを帯びていても良い。

【0026】図9は、前記第1の実施例である封止基板6、6を備えた積層型圧電共振子1に対して、圧電基板の振動電極上に空間を設けるように、圧電基板の略両端部を保持して収納する略直方体形状のケースを備えた、本発明における第8の実施例に係るケース型圧電共振子71である。このようにケース型圧電共振子71の場合にも、実装面である一方主面に対向する他方主面に存在する中間電極78または外部電極77、77、或いは中間電極78および外部電極77、77の幅方向の端縁に凹状部79、79又は凸状部を形成することにより、積層型圧電共振子と同じ効果が得られる。

【0027】

【発明の効果】以上のように本発明によれば、所要の静電容量を得る為に実装面に対向する面に存在する中間電極および外部電極のうち、少なくとも1つの電極の幅方向の端縁に任意の部分において任意の個数だけ凹凸状部を形成するので、圧電共振子の実装面においては安定した中間電極幅及び該中間電極と一対の外部電極とのギャップが得られる。従って、静電容量を少量にする場合でも実装面における中間電極への半田供給面積も狭くなることはなく、接続の信頼性は保守され実装不良は解消される。一方、静電容量を多量にする場合においても実装面における中間電極と一対の外部電極とのギャップが狭くならない為、供給される半田同士が接触することはない。

【図1】



く、絶縁の信頼性は保守され品質不良は解消される。

【図面の簡単な説明】

【図1】本発明における第1の実施例に係る積層型圧電共振子の斜視図。

【図2】本発明における第1の実施例に係る積層型圧電共振子のA-A'の垂直断面図。

【図3】本発明における第2の実施例に係る積層型圧電共振子の斜視図。

【図4】本発明における第3の実施例に係る積層型圧電共振子の斜視図。

【図5】本発明における第4の実施例に係る積層型圧電共振子の斜視図。

【図6】本発明における第5の実施例に係る積層型圧電共振子の斜視図。

【図7】本発明における第6の実施例に係る積層型圧電共振子の斜視図。

【図8】本発明における第7の実施例に係る積層型圧電共振子の斜視図。

【図9】本発明における第8の実施例に係るケース型圧電共振子の斜視図。

【図10】第1の従来例における積層型圧電共振子の斜視図。

【図11】第1の従来例における積層型圧電共振子のB-B'の垂直断面図。

【図12】第2の従来例における積層型圧電共振子の斜視図。

【図13】第3の従来例における積層型圧電共振子の斜視図。

【符号の説明】

1, 11 圧電共振子

2, 12 圧電基板

3 振動電極

4 入出力電極

5 接着剤

6, 16 封止基板

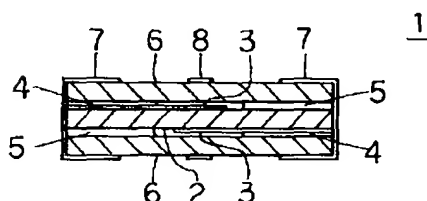
7, 17 外部電極

8, 18 中間電極

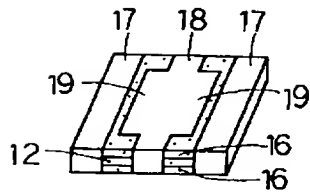
9 中間電極の幅方向の端縁に形成される凹状部

19 中間電極の幅方向の端縁に形成される凸状部

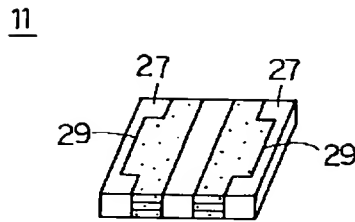
【図2】



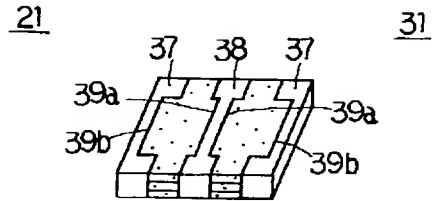
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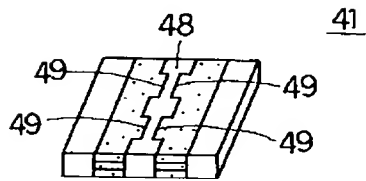
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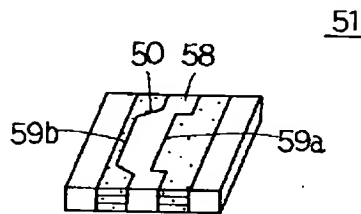
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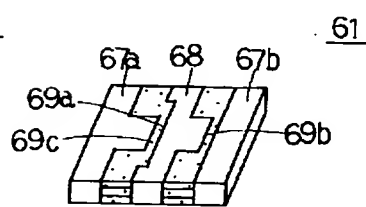
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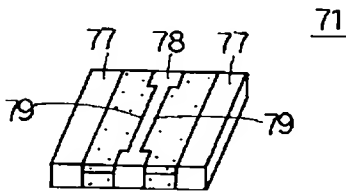
【図7】



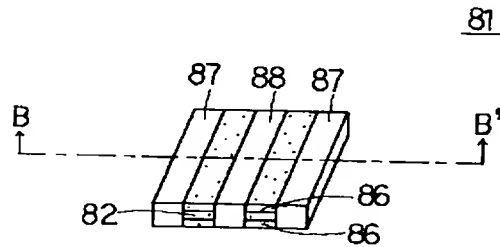
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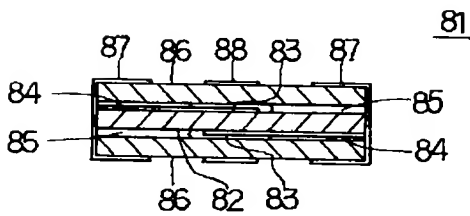
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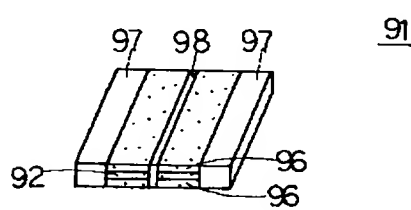
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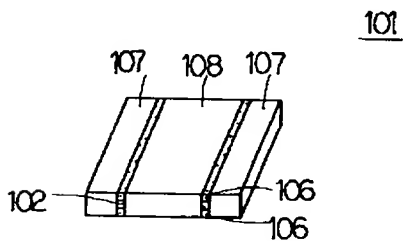
【図11】



【図12】



【図13】



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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The perspective diagram of the laminating type piezo resonator concerning the 1st example in this invention.

[Drawing 2] The vertical cross section of A-A' of the laminating type piezo resonator concerning the 1st example in this invention.

[Drawing 3] The perspective diagram of the laminating type piezo resonator concerning the 2nd example in this invention.

[Drawing 4] The perspective diagram of the laminating type piezo resonator concerning the 3rd example in this invention.

[Drawing 5] The perspective diagram of the laminating type piezo resonator concerning the 4th example in this invention.

[Drawing 6] The perspective diagram of the laminating type piezo resonator concerning the 5th example in this invention.

[Drawing 7] The perspective diagram of the laminating type piezo resonator concerning the 6th example in this invention.

[Drawing 8] The perspective diagram of the laminating type piezo resonator concerning the 7th example in this invention.

[Drawing 9] The perspective diagram of the case-mold piezo resonator concerning the example of the octavus in this invention.

[Drawing 10] The perspective diagram of the laminating type piezo resonator in the 1st conventional example.

[Drawing 11] The vertical cross section of B-B' of the laminating type piezo resonator in the 1st conventional example.

[Drawing 12] The perspective diagram of the laminating type piezo resonator in the 2nd conventional example.

[Drawing 13] The perspective diagram of the laminating type piezo resonator in the 3rd conventional example.

[Description of Notations]

1 11 Piezo resonator

2 12 Piezo-electric substrate

3 Vibrating Electrode

4 I/O Electrode

5 Adhesives

6 16 Closure substrate

7 17 External electrode

8 18 Bipolar electrode

9 Concave Section Formed in Edge of Cross Direction of Bipolar Electrode

19 Height Formed in Edge of Cross Direction of Bipolar Electrode

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the surface mount type piezo resonator with a built-in capacitor used for an oscillator circuit, a filter circuit, etc.

[0002]

[Description of the Prior Art] The perspective diagram of this conventional kind of laminating type piezo resonator 81 is shown in drawing 10, and the vertical cross section of this piezo resonator 81 is shown in drawing 11. The I/O electrodes 84 and 84 of the couple through which it flows in the vibrating electrodes 83 and 83 which the piezo-electric substrate 82 of a piezo resonator 81 counters are formed in the both ends of a principal plane.

[0003] In order to prepare the space which enables vibration of vibrating electrodes 83 and 83, it leaves the circumference to this piezo-electric substrate 82 vibrating electrode 83 and 83 top, and adhesives 85 and 85 are applied to it, it pasted up so that two closure substrates 86 and 86 might pinch the aforementioned piezo-electric substrate 82 from the upper and lower sides through these adhesives 85 and 85, and the layered product of an abbreviation rectangular parallelepiped configuration is accomplished. In addition, since the glue line formed by the aforementioned adhesives 85 and 85 should just be applied to the grade which can vibrate vibrating electrodes 83 and 83, even if it sees [of a piezo resonator 81] with the naked eye from an end face in practice, it does not appear in many cases.

[0004] It is formed also in the both-sides side where the external electrodes 87 and 87 of the couple through which it flows in the I/O electrodes 84 and 84 of the couple of the piezo-electric substrate 82 are continuously formed in both the principal planes and the ends side which counters where a piezo resonator 81 counters by fixed width of face, and counter in the both ends of a piezo resonator 81.

[0005] A bipolar electrode 88 is continuously formed in both the principal planes that a piezo resonator 81 counters, and the ends side which counters by fixed width of face, and an electrostatic part by volume is formed in the middle of the external electrodes 87 and 87 of this couple between a bipolar electrode 88 and the external electrodes 87 and 87 of a couple, respectively.

[0006] As shown in drawing 12 here, it is narrow in the electrode width of face of the bipolar electrode 98 formed succeeding both the principal planes and the ends side which counters where a piezo resonator 91 counters, and if the gap of this bipolar electrode 98 and the external electrodes 97 and 97 of a couple is made large, more nearly little electrostatic capacity will be obtained.

[0007] As shown in drawing 13 on the contrary, it is large in the electrode width of face of the bipolar electrode 108 formed succeeding both the principal planes and the ends side which counters where a piezo resonator 101 counters, and if the gap of this bipolar electrode 108 and the external electrode 107, 107 of a couple is narrowed, a lot of electrostatic capacity will be obtained.

[0008]

[Problem(s) to be Solved by the Invention] There are the following troubles in the aforementioned conventional piezo resonator. Since the electrode width of face of a bipolar electrode 98 was narrowly formed in order to obtain more nearly little electrostatic capacity, the piezo resonator 91 had the case

where the reliability of connection was not acquired but it became poor narrowly from a bird clapper also mounting the solder supply area to the bipolar electrode 98 in the component side of a piezo resonator 91 which is a principal plane on the other hand at the time of mounting to the printed circuit board which is not illustrated.

[0009] Since the gap of a bipolar electrode 108 and the external electrode 107,107 of a couple was narrowly formed in order to obtain a lot of electrostatic capacity, at the time of mounting to the printed circuit board which is not illustrated, between the bipolar electrodes 108 and the external electrodes 107,107 of a couple in the component side of a piezo resonator 101 which is a principal plane on the other hand, the reliability of an insulation -- the solder supplied contacts and short-circuits -- was not acquired, but one piezo resonator 101 had the case where it became poor [quality]. this invention aims at solving such a problem.

[0010]

[Means for Solving the Problem] The piezo-electric substrate by which the I/O electrode of the couple through which it flows in the vibrating electrode which counters in order that this invention may attain the above purpose was formed in the both ends of a principal plane, Prepare space on the vibrating electrode of this piezo-electric substrate, have the closure substrate pasted up so that a piezo-electric substrate might be pinched from the upper and lower sides, and the layered product of an abbreviation rectangular parallelepiped configuration is accomplished. In the piezo resonator by which the external electrode of the couple through which it flows in the I/O electrode of the couple of the aforementioned piezo-electric substrate was formed in the both ends of this layered product, and the bipolar electrode was formed in the middle of the external electrode of this couple The piezo resonator characterized by forming the irregularity-like section in the edge of the cross direction of at least one electrode among the bipolar electrode which exists in the component side of a piezo resonator and the field which counters, and an external electrode is supplied. Or so that space may be prepared on the vibrating electrode of the piezo-electric substrate by which the I/O electrode of the couple through which it flows in the vibrating electrode which counters was formed in the both ends of a principal plane, and this piezo-electric substrate It has the case of the abbreviation rectangular parallelepiped configuration which holds and contains the abbreviation both ends of a piezo-electric substrate. In the piezo resonator by which the external electrode of the couple through which it flows in the I/O electrode of the couple of the aforementioned piezo-electric substrate was formed in the both ends of this case, and the bipolar electrode was formed in the middle of the external electrode of this couple The piezo resonator characterized by forming the irregularity-like section in the edge of the cross direction of at least one electrode among the bipolar electrode which exists in the component side of a piezo resonator and the field which counters, and an external electrode is supplied.

[0011]

[Function] As mentioned above, in order to obtain necessary electrostatic capacity according to this invention, the gap of the bipolar-electrode width of face and this bipolar electrode which were stabilized in the component side whose piezo resonator is a principal plane on the other hand since the irregularity-like section is formed in the edge of the cross direction of at least one electrode among the bipolar electrode which exists in the principal plane and the another side principal plane which counters which is a component side, and an external electrode, and the external electrode of a couple is obtained.

[0012]

[Example] Drawing 1 is the perspective diagram of the laminating type piezo resonator 1 concerning the 1st example in this invention, and drawing 2 is the vertical cross section of this piezo resonator 1. The piezo resonator 1 consists of the piezo-electric substrate 2, adhesives 5, 5 or 2 closure substrates 6 and 6, external electrodes 7 and 7 of a couple, and a bipolar electrode 8.

[0013] The vibrating electrodes 3 and 3 of the principal plane which the piezo-electric substrate 2 counters which counter are mostly formed in the center, and the I/O electrodes 4 and 4 of the couple through which it flows in these vibrating electrodes 3 and 3 are formed in the both ends of a principal plane.

[0014] In order to prepare the space which enables vibration of vibrating electrodes 3 and 3, it leaves the

circumference to the principal plane which this piezo-electric substrate 2 counters vibrating electrode 3 and 3 top, and adhesives 5 and 5 are applied to it, it pasted up so that two closure substrates 6 and 6 might pinch the piezo-electric substrate 2 from the upper and lower sides through these adhesives 5 and 5, and the layered product of an abbreviation rectangular parallelepiped configuration is accomplished. In addition, since the glue line formed by the aforementioned adhesives 5 and 5 should just be applied to the grade which can vibrate vibrating electrodes 3 and 3, even if it sees [of a piezo resonator 1] with the naked eye from an end face in practice, it does not appear in many cases.

[0015] It is formed also in the both-sides side where the external electrodes 7 and 7 of the couple through which it flows in the I/O electrodes 4 and 4 of the couple of the piezo-electric substrate 2 are continuously formed in both the principal planes and the ends side which counters where a piezo resonator 1 counters by fixed width of face, and counter in the both ends of a piezo resonator 1.

[0016] A bipolar electrode 8 is formed in the middle of the external electrodes 7 and 7 of this couple succeeding both the principal planes and the ends side which counters where a piezo resonator 1 counters, and an electrostatic part by volume is formed in it between a bipolar electrode 8 and the external electrodes 7 and 7 of a couple, respectively.

[0017] If the broad concave sections 9 and 9 are formed in the ends edge of the cross direction of the bipolar electrode 8 which exists in the another side principal plane which is a component side of a piezo resonator 1, and which counters a principal plane on the other hand as shown in drawing 1 here In an another side principal plane, the electrode width of face of a bipolar electrode 8 is narrow, and the gap of this bipolar electrode 8 and the external electrodes 7 and 7 of a couple becomes large, and can make little electrostatic capacity obtained between a bipolar electrode 8 and the external electrodes 7 and 7 of a couple, respectively.

[0018] And since what was been fixed and stabilized is obtained, there is no electrode width of face of the portion which is the component side of a bipolar electrode 8 and which was formed on the other hand succeeding the principal plane and the ends side which counters with a bird clapper narrowly [the solder supply area to the bipolar electrode 8 in the component side of a piezo resonator 1] at the time of mounting to the printed circuit board which is not illustrated.

[0019] Drawing 3 is the perspective diagram of the laminating type piezo resonator 11 concerning the 2nd example in this invention. The piezo resonator 11 consists of the piezo-electric substrate 12, adhesives, two closure substrates 16 and 16, external electrodes 17 and 17 of a couple, and a bipolar electrode 18, and the piezo-electric substrate 12 except a bipolar electrode 18, adhesives, two closure substrates 16 and 16, and the external electrodes 17 and 17 of a couple are as common as the thing of the piezo resonator 1 concerning the 1st example of the above respectively.

[0020] A bipolar electrode 18 is formed in the middle of the external electrodes 17 and 17 of the couple of a piezo resonator 11 succeeding both the principal planes and the ends side which counters where a piezo resonator 11 counters, and an electrostatic part by volume is formed in it between a bipolar electrode 18 and the external electrodes 17 and 17 of a couple, respectively.

[0021] If the broad heights 19 and 19 are formed in the ends edge of the cross direction of the bipolar electrode 18 which exists in the another side principal plane which is a component side of a piezo resonator 11, and which counters a principal plane on the other hand as shown in drawing 3 here In an another side principal plane, the electrode width of face of a bipolar electrode 18 is wide, and the gap of this bipolar electrode 18 and the external electrodes 17 and 17 of a couple becomes narrow, and can make abundant electrostatic capacity obtained between a bipolar electrode 18 and the external electrodes 17 and 17 of a couple, respectively.

[0022] And since what was been fixed and stabilized by the electrode width of face of the portion which is the component side of a bipolar electrode 18, and which was formed on the other hand succeeding the principal plane and the ends side which counters is obtained, the solder supplied between a bipolar electrode 18 and the external electrodes 17 and 17 of a couple in the component side of a piezo resonator 11 at the time of mounting to the printed circuit board which is not illustrated does not contact.

[0023] It is effective, when forming the concave sections 29 and 29 or the height in the edge of the cross direction of the external electrodes 27 and 27 of a couple which exist in the another side principal plane

which is a component side of the laminating type piezo resonator 21, and which counters a principal plane on the other hand, as shown in drawing 4 as the 3rd example. Or it is effective, when forming the concave sections 39b and 39b or the height in the edge of the cross direction of the external electrodes 37 and 37 of a couple, while forming the concave sections 39a and 39a or the height in the ends edge of the cross direction of a bipolar electrode 38 which exists in the another side principal plane which is a component side of the laminating type piezo resonator 31, and which counters a principal plane on the other hand, as shown in drawing 5 as 4th example.

[0024] In addition, like forming the four concave sections 49, 49, 49, and 49 in the bipolar electrode 48 of the laminating type piezo resonator 41 shown in drawing 6 as the 5th example, when forming two or more concave sections or heights, the number is arbitrary [the irregularity-like section as used in a specification].

[0025] It is effective, when it differs in the electrostatic capacity which forms both concave section 59a and height 59b in each edge of the cross direction of a bipolar electrode 58 which exists in the another side principal plane which is a component side of the laminating type piezo resonator 51, and which counters a principal plane on the other hand, and is obtained by each, as shown in drawing 7 as the 6th example. Or it is effective, when forming concave section 69c or the height in the edge of the cross direction of one external electrode 67a, while forming both irregularity of concave section 69a and height 69b in each edge of the cross direction of a bipolar electrode 68 which exists in the another side principal plane which is a component side of the laminating type piezo resonator 61, and which counters a principal plane on the other hand, as shown in drawing 8 as 7th example. Moreover, like the crank section 50 which constitutes height 59b of the bipolar electrode 58 shown by drawing 7, the crank section which constitutes the irregularity-like section could be restricted right-angled, but may wear the obtuse angle, the acute angle, or the radius of circle.

[0026] Drawing 9 is the case-mold piezo resonator 71 concerning the example of the octavus in this invention equipped with the case of the abbreviation rectangular parallelepiped configuration which holds and contains the abbreviation both ends of a piezo-electric substrate, as space is prepared on the vibrating electrode of a piezo-electric substrate to the laminating type piezo resonator 1 equipped with the closure substrates 6 and 6 which are the 1st example of the above. Thus, the same effect as a laminating type piezo resonator is acquired by forming the concave sections 79 and 79 or the height in the edge of the cross direction of the bipolar electrode 78 which exists at the another side principal plane which is a component side, and which counters a principal plane on the other hand also in the case of the case-mold piezo resonator 71, the external electrodes 77 and 77 or a bipolar electrode 78, and the external electrodes 77 and 77.

[0027]

[Effect of the Invention] Since only the arbitrary numbers form the irregularity-like section in portions arbitrary to the edge of the cross direction of at least one electrode among the bipolar electrode which exists in a component side and the field which counters, and an external electrode according to this invention as mentioned above in order to obtain necessary electrostatic capacity, the gap of the bipolar-electrode width of face and this bipolar electrode which were stabilized in the component side of a piezo resonator, and the external electrode of a couple is obtained. Therefore, even when making electrostatic capacity little, the solder supply area to the bipolar electrode in a component side is also narrow, with a bird clapper, there is nothing, the reliability of connection is maintained and poor mounting is canceled. On the other hand, since the gap of the bipolar electrode and the external electrode of a couple in a component side does not become narrow when making electrostatic capacity abundant, the solder supplied does not contact, the reliability of an insulation is maintained and poor quality is canceled.

[Translation done.]